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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/992,980	11/06/2001	Ja-Hum Ku	SAM-0266	7596

7590

09/11/2003

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EXAMINER
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LEE, CALVIN

ART UNIT	PAPER NUMBER
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2825

DATE MAILED: 09/11/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/992,980

Applicant(s)

KU ET AL.

Examiner

Lee Calvin

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 May 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

**FINAL ACTION*****Response to Amendment***

1. The amendment of claims 1, 2, and 4, filed on May 29, 2003, is acknowledged.

***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. No disclosure related to "non-inert nitrogen" is found in the specification.

***Claim Rejections - 35 U.S.C. § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Rha* (US 6,284,634) in view of *Tanabe et al* (US 6,323,115).

a) *Rha* discloses a method of forming a metal gate electrode, comprising of:

- forming the metal gate electrode comprised of a polysilicon layer 43, a W (tungsten) layer 44, and a cap layer 45 [Figs. 3 and 4C-4F]
- performing a selective oxidation process to the metal gate electrode pattern in an ammonia comprising a nitrogen which combines with the W layer to form a tungsten nitride 47 [col. 4]

*Rha* does not suggest a conductive barrier. *Tanabe et al* teaches forming a WN (tungsten nitride) barrier layer 11 underlying a tungsten layer 12 [Fig. 7 and 19a].

It would have been obvious to one having ordinary skill in the art to have modified the metal gate electrode of *Rha* by utilizing a barrier for the purpose of prevent metal ions from entering underlying semiconductor layers.

b) In re claim 4, *Rha* teaches a method for suppressing abnormal oxidation of W or  $WSi_x$  line by forming a WN on an outer wall of the gate line in a highly integrated device. However, *Rha* does not suggest that "the nitrogen permeates a metal oxide layer, decreases surface mobility of the metal oxide layer and prevents formation of nucleation cities of whiskers on the metal oxide layer.

It would have been obvious to one having ordinary skill in the art to have modified the process of *Tanabe et al* by utilizing the claimed functional recitation because it is notoriously

well known in the art as seen by the plethora of prior art cited above and also in US 4,505,028 to *Kobayashi et al* '028, *Yuuki* '212, and *Weimer et al* '380. They all teach that only silicon-containing layer is selectively oxidized (without oxidizing a metal layer) as a result of performing a selective oxidation process to a semiconductor structure in a nitrogen-containing gas ambient (including water vapor and/or hydrogen). An oxide film being formed with the selective oxidation must have a dense film quality (compared to other oxide films formed by a conventional thermal oxidation), thereby improving electrical insulation. Consequently, whiskers or hillocks are less likely formed on the structure.

### *Response to Arguments*

6. Applicants argued "in *Tanabe et al* there is no teaching or suggestion of introducing a non-inert nitrogen-containing gas into the process chamber during an oxidation reaction to form metal nitride on a metal gate electrode structure". Examiner disagrees because *Tanabe et al* teaches that during the oxidation process the nitrogen, combined with the metal electrode, reacts to inherently form a metal nitride [col. 18, lns.35-37]. Please note also in the rejection above, that the specific portions of *Rha* in view of *Tanabe et al*, relied upon by the Examiner to reject claims 1-8 have been pointed out. Therefore, Applicant's arguments are moot in light of a new rejection.

7. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire three months from the mailing date of this action. In the event a first reply is filed within two months of the mailing date of this final action and the advisory action is not mailed until after the end of the three-month shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than six months from the date of this final action.

Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at 703-306-5854, Monday to Thursday, from 7 to 5 (ET). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *Matthew Smith* whose telephone number is 703-308-1323

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The fax phones are (703) 872-9318 for regular communications and (703) 872-9319 for After-Final communications.

*C. Everhart*  
CARIDAD EVERHART  
PRIMARY EXAMINER

CL

August 18, 2003